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Indian Standard
GUIDANCE ON SUBJECTIVE LISTENING TESTS

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GUIDANCE ON SUBJECTIVE LISTENING TESTS

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(*Continued on page* 2)

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*Shri H. S. Jolly was the Chairman for the meeting in which this standard was finalized.

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Indian Standard

GUIDANCE ON SUBJECTIVE LISTENING TESTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 July 1981, after the draft finalized by the Radio Communications Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 This standard is largely based on IEC Pub 543(1976) 'Informative guide for subjective listening tests' issued by the International Electrotechnical Commission (IEC).

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard gives informative guidance regarding subjective listening tests on radio receivers.

2. PRINCIPLE OF SUBJECTIVE LISTENING TESTS

2.1 A need exists for reproducible subjective listening tests, because objective measurements alone have not been found adequate for determining sound quality. However, as subjective tests have an inherent degree of uncertainty, objective tests should still be used wherever possible, particularly for those parameters that are to be included in the terms of a contract.

2.2 The purpose of this guide is to define procedures that will permit comparison of the acoustical performance of various types of household or other similar sound radio receivers, in a controlled environment and with an established procedure, to give results that are as reproducible as possible. The listening tests are carried out by comparison against a reference receiver. The reference receiver shall be selected with great care in all cases, because the comparative judgements made are dependent on this reference. A description of the reference receiver shall also be given with the results.

---

*Rules for rounding off numerical values (*revised*).

2.3 A subjective evaluation, based on this guide, consists of the average judgement of several persons on a given subject. The individual opinions are divided into ranges corresponding to assessment scales, showing for each range the number of persons of that opinion. In this way, the subjective evaluation may be presented as an average opinion with a standard deviation.

2.4 Receivers should be divided into categories of use for comparison so that each is judged within its own category.

Such categories might be, for example:

A : personals (pocket receivers)	A1 AM personals A2 FM personals A3 AM/FM personals
B : portables	B1 AM portables B2 AM/FM portables
C : table sets for A.M.	C1 table sets for AM C2 table sets for AM/FM

D : other receivers (for example, larger radiograms)

E : High-fidelity equipment.

3. CHARACTERISTICS OF THE TEST ROOM

3.1 For consumer testing, a room of the same type as a living room with the average characteristics of domestic surroundings is advisable.

3.1.1 It is advisable to use a room of the same type as a living room in which the shortest side should be not less than 3·5 m (*see* Appendix A) in order to be able to measure stereophonic equipment (stereo basis >2·5m).

3.2 The acoustic response of the room shall be fairly smooth and the reverberation time shall be that of a typical living room.

3.2.1 This time is approximately 0·5 ± 0·1 s at 500 Hz (inclusive of panelists).

3.2.2 Over the frequency range 100—5 000 Hz there shall not be any unusual room resonances nor flutter echo.

3.3 The lighting within the room shall be of medium intensity, so arranged that the lights do not shine directly into the eyes of any panelists.

3.3.1 Temperature shall be in the range 15° to 35°C.

3.3.2 Relative humidity shall be in the range 45 to 75 percent.

NOTE—Damping elements consisting of domestic furniture, curtains and carpets are to be preferred to sound absorbing panels in ensuring the correct relationship between reverberation time and frequencies.

Rooms with solid floors (covered with pile carpet) and without large areas of glazing are easier to correct.

3.4 The recommended background sound level is less than 35 dB (A) determined with a sound level meter. If this level is exceeded, the level shall be stated with the results.

3.5 The volume of the reference equipment and that of the receiver under test shall be adjusted to a level acceptable to the listening panel.

3.6 As purely indicative, sound levels for 'medium' receivers of 75 dB (A) are suitable for listening in living room, that is, the sound level for domestic purposes shall be as follows:

a) for small receivers	approximately 60 dB (A)
b) for medium receivers	75 dB (A)
c) for large and Hi-Fi receivers	80-85 dB (A) (*see* also **10.1**)

4. NUMBER OF PANELISTS

4.1 A representative sample of observers for comparison for a statistically high level of confidence is twenty or more.

4.2 For most purposes, the number of panelists may be reduced to seven (or even less); such panels have been found to give reproducible results, if precautions are taken as specified in **5** and **11.**

5. QUALIFICATION OF PANELISTS

5.1 The panel shall be a representative sample of users of the particular type of equipment under test.

5.2 Consequently, the matters to be considered are as follows:

a) experts/laymen,

b) degree of musical appreciation,

c) age,

d) sex, and

e) hearing ability.

5.3 In general, an appropriate audio test should make it possible to verify that the listeners do not have a very reduced hearing ability.

5.4 In certain cases it may be convenient to select panelists in a particular manner, especially when the panel has to be small.

5.5 Such a selection may be made in different ways, for example, one may use the personal standard deviation derived from previous tests, or by an audiogram that indicates the following:

a) the perception of sound level differences of approximately 3 dB and change of pitch of 1 percent at 1 000 Hz;

b) a sensitivity of hearing in the frequency range up to 7 kHz not worse than the appropriate value indicated in the diagrams in Appendix B, and

c) the ability to place accurately the image position of a 'pink noise' (*see* Note 2) signal source fed to a pair of loudspeakers, set up in the normal stereo fashion.

Note 1 —For table radios, portable radios and low and medium priced gramophones, the panel of listeners need not be musically educated, but they should be musically perceptive.

For high quality radios and gramophones, 'high-fidelity system', the procedures is generally similar, except that at least half the panel shall be musically educated.

Note 2 — 'Pink noise' is oscillation whose spectrum is uniform as a function of frequency, over a designated frequency range, as measured in a band width proportional to the frequency.

5.6 As far as possible, the composition of the panel shall be such that the number of men and women is equal in each age group as shown in Table 1.

5.7 With a higher number of panelists repeated tests shall be made maintaining the ratios given in Table 1.

5.8 In any case, the composition of the panel shall be stated with the results.

6. ARRANGEMENT OF THE RECEIVERS

6.1 The receivers under test shall not be visible to the panel (this is to avoid psychological influences) and shall be placed behind a sound transparent curtain.

6.2 It is suggested that the layout of the test room should be in the general form shown in the diagram in Appendix A (the illustration is for both stereophonic and monophonic equipment as appropriate).

TABLE 1 SUGGESTED COMPOSITION OF THE PANEL

(*Clause* 5.6)

	Number of Panelists		
	Minimum	Recommended	Maximum
Sex			
Men	2	3 or 4	5
Women	2	4 or 3	5
Total	4	7	10
Age			
Between 15 and 40	2	4	5
Between 40 and 60	1	2	3
Over 60	1	1	2
Total	4	7	10

6.3 The microphone (M) of a sound level meter is suspended among the panelists above head level.

6.4 As far as possible, loudspeakers of the stereophonic equipment under test shall be placed at such distance (D) apart and from the listeners as are recommended in the manufacturer's instructions, but in no case shall listener 1 be at a distance (H) less than 2·5 m from the curtain.

6.5 This arrangement is also satisfactory for monophonic equipment, but not for the case of pocket radio.

6.6 A monophonic radio is placed in the centre and just behind the sound curtain.

6.7 All loudspeakers other than those intended to stand on the floor shall be placed on a solidly constructed wooded table, 750-800 mm in height, such that the loudspeakers are at the same distance from the edge of the table nearest to the panel.

6.8 When testing pocket radios, the panelists shall hold the receivers in their hands, covered if possible.

7. REFERENCE EQUIPMENT

7.1 It is essential to make the assessment by comparison with a reference receiver, preferably a sample which is of a quality corresponding to the characteristic under consideration and near to the centre of the grading scale.

7.2 In addition, a receiver of the highest quality may be used as evidence of achievable sound quality.

7.3 Consistency between different series of evaluations may be achieved using the same test equipment for comparison.

8. SIGNAL INPUT

8.1 A predetermined programme according to **9** shall be recorded on and reproduced by means of a high quality tape deck.

8.2 The audio frequency output from the tape deck shall be fed to a signal generator and thence as a radio frequency signal (AM or FM) fed to the radio receivers under test, by means of a radio loop or by suitable coupling means, for example, a magnetic aerial or as a voltage via the proper aerial impedance network.

8.3 The level of the signal shall have an appropriate value and be substantially the same for each receiver. For receivers with audio frequency input the tape deck output is fed through a matching network to this input in a separate test.

8.4 The characteristics of the signal, especially the depth of modulation in the case of AM and the frequency deviation and the pre-emphasis characteristics in the case of FM, shall correspond closely to the transmission standard used.

8.5 The levels of the input signals used shall be stated with the results.

9. CHARACTERISTICS OF THE MODULATION SIGNALS

9.1 The programme shall include the following:

a) Classical music (a symphonic piece, a chamber music piece and an operatic song).

b) Popular music (light rhythmical music of all type, including light classical, dance, and jazz, with and without vocals).

c) Speech in different languages.

9.2 In the case of vocal transmission of a text, the speaker shall have an excellent diction. Suggested duration of each type vary approximately as follows:

a) for pink noise	:	1 min
b) for classical music	:	3 min
c) for light music	:	6 min
d) for speech	:	3 min

9.3 Each test piece shall not last more than 20s and shall be played through the reference equipment immediately before being played through the equipment under test.

9.4 This procedure is to be repeated for each test piece and for each receiver tested.

9.5 A switchboard shall be used, so that quick changes between the reference receiver and test receivers are possible (with period of silence about 0·5s).

10. PROCEDURE

10.1 Adjustment of Volume Controls

10.1.1 The tests shall be conducted using the same volume level for the reference receiver and the receiver(s) under test as determined by the sound level meter referred to in **6** using a 'pink noise' modulation.

10.1.2 Volume has to be chosen according to the type of the test programme [about 75 dB (A) for 'medium' receivers, about 60 dB (A) for 'small' receivers, and 80-85 dB (A) for 'Hi-Fi' equipment].

10.1.3 The position and height at which the sound pressure levels are measured shall be stated with the results. It is desirable to use for the measurement the level meter having the slow time constant of weighting curve A prescribed in IS : 3932-1966*.

10.1.4 A short test shall also be made at high volume setting to indicate any unwanted resonance or other forms of distortion both electrical and mechnical.

10.2 Adjustment of Tone Controls

10.2.1 The controls for treble and bass shall be set to linear frequency response. As far as possible, tests may also be made with other setting of the tone control and this shall be recorded with the results.

10.2.2 For table of minimum checks to be made (*see* Appendix C).

---

*Specification for sound level meter for general purpose use.

10.3 Evaluation

10.3.1 The total sound impression (overall sound quality) and the intelligibility of speech shall be evaluated.

10.3.2 In addition to or as part of these tests the panel may be asked to evaluate, for example:

a) the reproduction of low notes and balance between the two

b) the reproduction of high notes

c) the absence of harshness

d) the absence of hum

e) the absence of distortion

f) the absence of crackle and other undesirable noise

g) the reproduction of transients.

10.3.3 For the judgement of the stereophonic effect, a specially prepared tape shall be used in relation to which the position of the instruments across the stage is known.

10.3.4 Separate judgements shall be recorded for AM and FM.

10.3.5 The intelligibility of speech, if necessary, may be expressed as a percentage of the number of words understood in relation to the number of words transmitted, when using a special series of words.

10.3.6 Alternatively, the judgement may be expressed by the panel in terms of the scales in **13.2**, when using various types of normal speech.

10.3.7 The judgement of total sound impression shall be the final evaluation.

11. CONDITIONS OF WORK AND INSTRUCTIONS TO THE PANEL

11.1 The panel shall not be asked to make judgements for more than 20 min without a break, and the break shall be at least equal in time to the time they have marked.

11.2 A session shall not last more than 2 h, including both working periods and breaks.

NOTE — The persons in charge of the tests shall ensure that the questions addressed to the panel are clear and simple.

The panel shall be carefully instructed before the start of each test session concerning:

a) the category of the receiver being tested,

b) the way in which the test will be conducted, and

c) the method of scoring to be used.

12. MAINS INPUT AND STABILITY CONDITIONS

12.1 Signal strength and mains input shall not be varied, and interfering signals shall not be perceptible during normal listening tests.

12.2 However, the effects of interference may be evaluated by a listening panel, if required.

13. SCORING AND SCALES OF SUBJECTIVE GRADINGS

13.1 The scoring shall be considered for every item and the final scores of each item obtained expressed in terms of a mean opinion and the corresponding standard deviation.

13.1.1 Scoring is to be made for each receiver and each example of programme.

NOTE — The mean value and the standard deviation are calculated as follows:

$$\text{Mean value, } P_m = \frac{\sum_1^n P_i}{n}$$

$$\text{Standard deviation, } s = \sqrt{\frac{\sum_1^n (P_m - P_i)^2}{n-1}}$$

where P_1 ...... P_i ...... P_n are the n different marks obtained.

Should there be a wide dispersion among the panelists, these parts of the test in question may possibly have to be repeated and the panelists be asked to evaluate it again.

The score to be used by each panelist for each receiver and each section of the test is as follows.

13.2 Scales of Evaluation

13.2.1 *Comparative grades* are as follows*:

−2 : much worse = 2 points
−1 : worse = 4 points
0 : same as = 6 points
+1 : better = 8 points
+2 : much better = 10 points

13.2.2 *Absolute grades are as follows:*

Impairment	*Quality*
5 : imperceptible	5 : excellent
4 : perceptible but not annoying	4 : good
3 : perceptible, slightly annoying	3 : fair
2 : annoying	2 : poor
1 : very annoying	1 : bad

13.2.3 Either a comparison or an absolute classification shall be used as appropriate.

NOTE—It is recognized that to suit local use, some laboratories may wish to replace the numbers with letters or points.

However, it is proposed that the results shall be converted to the form given above.

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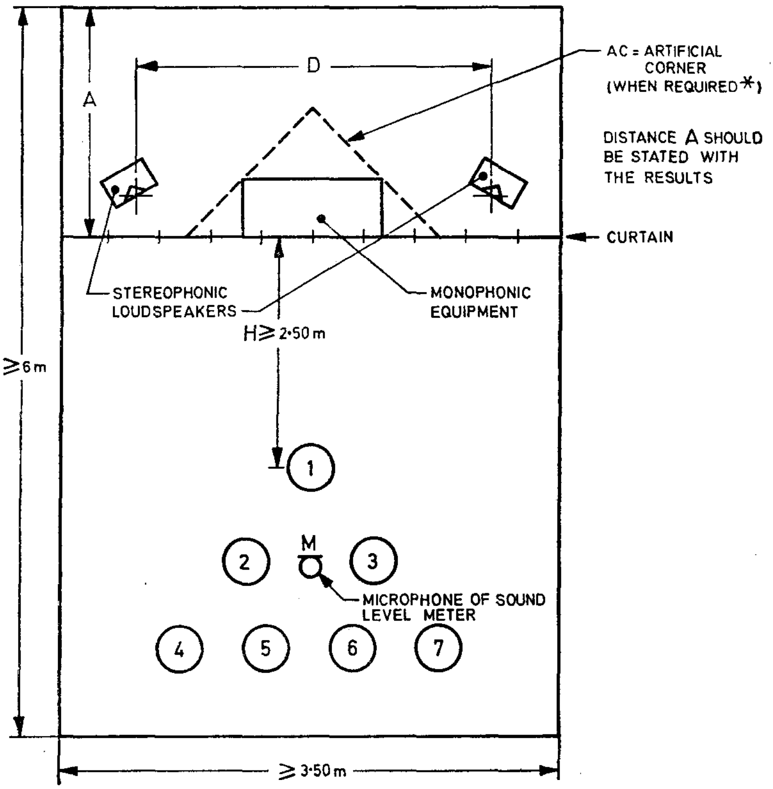
*This comparison scale is a simplified version of the 7 point scale now recommended by CCIR for sound.

APPENDIX A

(*Clauses* 3.1.1 *and* 6.2)

LAYOUT OF THE TEST ROOM



D
A
AC = ARTIFICIAL CORNER (WHEN REQUIRED*)
DISTANCE A SHOULD BE STATED WITH THE RESULTS
CURTAIN
STEREOPHONIC LOUDSPEAKERS
MONOPHONIC EQUIPMENT
H≥2·50 m
≥6 m
1
2
M
3
MICROPHONE OF SOUND LEVEL METER
4
5
6
7
≥3·50 m

FIG. 1

---

*NOTE — The construction of the artificial corner is most important, since most light-weight partitioning will cause unfair bass loss: the transmission attenuation shall be at least 20 dB, down to 100 Hz. It may be made up from a rectangular wooden framework constructed from 5·0 cm × 25 cm timber on both sides of which is fixed plaster board of 2 cm thickness, so that the internal separation of the boards is 5 cm. The intervening air space is loosely filled with fibre glass.

APPENDIX B

[*Clause* 5.5 (b)]

HEARING LOSS FREQUENCY CHARACTERISTICS OF MEN AND WOMEN FOR DIFFERENT AGE GROUPS

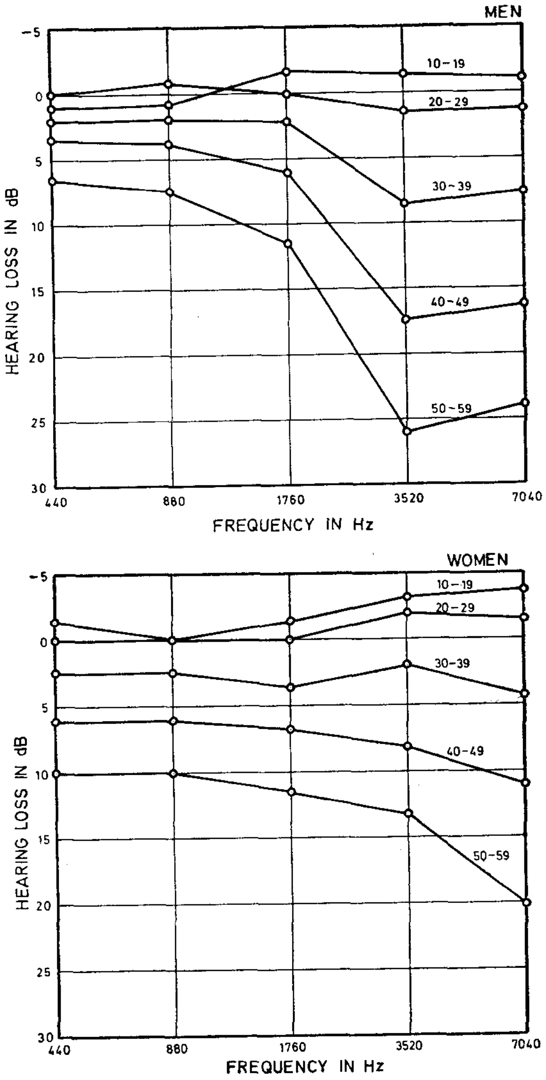


FIG. 2

APPENDIX C

(*Clause* 10.2.2)

TABLE OF MINIMUM CHECKS TO BE MADE

RECEIVER CATEGORY*	LEVEL ADJUSTMENT		SYMPHONY ORCHESTRA	ORGAN	SOLO	SONG SOPRANO	SPEECH		LIGHT MUSIC	
	VOLUME	TONE					I	II	DANCE BAND	JAZZ BAND
A ... D	normal†	*see* 10.2	×	×	×	×	×	×	×	×
E (Hi-Fi)	normal†	linear frequency response	×	×	×	×	×	×	×	×
A ... D	normal†	linear frequency response					×			×
E (Hi-Fi)	normal†	*see* 10.2					×			×
A ... E	high volume‡	*see* 10.2	×				×			

**See* Foreword.

†*See* 10.1 — approximate 75 dB(A) [small receivers approximate 60 dB(A)].

‡*See* 10.1 — approximate 80 dB to 85 dB(A).

INDIAN STANDARDS
ON
RADIO COMMUNICATIONS

IS:	
614-1964	Methods of measurements on receivers for amplitude modulation broadcast transmissions (*revised*)
615-1966	Minimum requirements of domestic radio receivers (*revised*)
616-1957	Code of safety requirements for mains-operated radio receivers
1885	Electrotechnical vocabulary:
(Part XVIII)-1967	General terms of radiocommunications
(Part XIX)-1967	Radiocommunication circuits
(Part XX)-1967	Radiowave propagation
(Part XXI)-1967	Aerials
(Part XXII)-1967	Equipments for radiocommunications, transmitting and receiving
(Part XXIII)-1967	Radio telegraphy and mobile radio
(Part XXIV)-1967	Broadcasting sound and television
(Part XXV)-1967	Radiolocation and radio-navigation
2032 (Part XVI)-1972	Graphical symbols used in electrotechnology: Part XVI Aerials
2032 (Part XX)-1977	Graphical symbols used in electrotechnology: Part XX Radio communication transmission circuits, lines and accessories
2731-1964	Methods of measurements on receivers for frequency modulation broadcast transmissions
3397-1978	Community radio receivers (*first revision*)
4545-1968	Methods of measurement on receivers for monochrome television broadcast transmissions
4546-1968	Methods of measurement of radiations from television receivers
4547-1978	Receivers for monochrome television broadcast transmissions (*first revision*)
6759-1972	Requirements for radio receivers for frequency modulation broadcast transmissions
6970-1973	Code of practice for protection against possible hazards in radio transmitting equipment
9031-1979	Teleprinter paper page rolls
9793 (Part I)-1980	TV receiving aerials for domestic use: Part I Methods of measurement